Diagnosis, Treatment and Maintenance of a Heavy Smoking Patient with Chronic Periodontitis - a Case Presentation

Maria Kandylaki, Niklaus P. Lang

This case presentation illustrates the systematic treatment and follow-up of a 55-year-old heavy smoker with advanced chronic periodontitis. The goal of the treatment was to arrest the progression of periodontitis and the restitute of normal function by reconstructing the occlusion. After the initial phase of treatment a surgical phase with hemisections and extractions of teeth was performed. The fixed prosthetic rehabilitation of the case was implemented without the use of dental implants. Patient follow-up was documented for two years after completion of therapy.

Key words: chronic periodontitis, furcation treatment, smoking, maintenance

A 55-year-old patient was referred to the clinic in the Department of Periodontology and Fixed Prosthodontics, University of Berne, Switzerland. The treatment plan suggested by the referring dentist foresaw the incorporation of a removable partial denture in the maxilla in order to replace the missing teeth. The patient's wish, however, was to be treated for his periodontal problems and to have the gaps in the lateral regions of the upper and lower arches closed by means of a fixed reconstruction (Figs. 1a, b and Figs. 2a, b).

Medical History

The patient was healthy and did not take any medications. However, he was a heavy smoker having smoked one to two packs of cigarettes a day for the past 30 years (at least 40 pack-years). He was a journalist and as such was not willing to reduce or quit his smoking habits because of work-related stress. Also, he habitually drank 5 to 6 cups of coffee a day.

Dental History

The patient had been previously treated for periodontal disease in 1997, but without any surgical interventions. In the following three years, he had been in recall every 4 months for supportive periodontal care. Hence, his most recent tooth cleaning had been performed four months before his attendance at the clinic. The referring dentist had noticed a slow progression of periodontitis despite the maintenance program instituted. He then informed the patient about the possibility of an antibiotic therapy and referred him to the clinic. One week before he came to the clinic he had his last visit with the referring dentist where tooth 17 was extracted for endodontic reasons. Subsequently, the patient complained about impaired chewing function, especially after the extraction of tooth 17. The other missing teeth also had been lost because of endodontic and periodontal problems.

Oral Hygiene

The patient indicated that he cleaned his teeth twice a day for 2 minutes with an electric toothbrush and occasionally used dental floss for the interdental spaces (Figs. 3a, b).
Examination

Extraoral Examination

No abnormalities such as indurations, ulcerations or tumors were detected extraorally.

Intraoral Examination

Similarly, no pathological findings were diagnosed on the oral mucosa, the tongue and the sublingual mucosal area. The salivary secretion rate appeared high and the saliva was very serous.

Figs. 2a, b  The missing teeth on the lateral sides caused impaired chewing function.

Figs. 3a, b  Staining and abrasions may be seen on the intra-oral views of the upper and lower arches.
Dental Examination

The patient had a dentition with 23 teeth. In the upper jaw, teeth 18, 17, 24, 26, 27 and 28 were missing. In the lower jaw, teeth 36, 46 and 48 were missing. Teeth 16, 15, 22 and 25 had been treated endodontically. All other teeth responded positively to the vitality test with compressed CO\textsubscript{2}. Teeth 16, 25, 35, 37 and 38 had amalgam fillings. Secondary caries was found at teeth 37 and 38. Composite fillings were present on 12, 13, 14, 23, 44 and 47, respectively. The distal aspect of tooth 23 had an initial carious lesion. A gold crown was present on tooth 15 and a porcelain crown on tooth 22 (Figs. 4a, 4b and Fig. 5).

Periodontal Screening

The basic periodontal screening examination (BPE) (Table 1) revealed a Code of 4 in all sextants except for the upper left lateral sextant where a Code of 3 was recorded. Furcation involvements of all remaining molars were marked with an asterisk (Table 2).
On the basis of the BPE it was decided to perform a comprehensive periodontal charting and to obtain a full mouth set of periapical radiographs.

Periodontal Examination
There were only moderate signs of inflammation in the gingival tissues. The periodontal chart showed probing pocket depths (PPD) up to 8 mm (Fig. 6). Teeth 16 and 37 had trough and trough furcation involvements (Grade 3, per Hamp et al., 1975 Classification). Teeth 14, 47 and 28 had grade 1 furcation involvements. Tooth mobility was grade 1.

### Table 1
The Basic Periodontal Examination (BPE) Measurements are made at two sites (mesial, distal) per tooth with a graduated periodontal probe (3, 5, 7, 10 mm) at a pressure of 0.25 N. The highest score in each sextant is noted.

| Score 0: | Probing depth ≤ 3 mm, absence of calculus, absence of overhanging reconstructions, absence of bleeding on probing |
| Score 1: | Probing depth ≤ 3 mm, absence of calculus, absence of overhanging reconstructions, but bleeding on probing |
| Score 2: | Probing depth ≤ 3 mm, presence of calculus and/or presence of overhanging reconstructions, bleeding on probing |
| Score 3: | Probing depth >3 mm - 5 mm |
| Score 4: | Probing depth > 5 mm |

*: Furcation involvement, mobility, mucogingival problems, recessions

### Table 2

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<td>Score 0</td>
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Fig. 6 Initial periodontal chart. The probing pocket depths ≥ 4 mm are marked in red color. The open circles represent the start of a furcation involvement (< 3 mm). The black circles (●) represent a furcation involvement of ≥ 3 mm.
(Ramfjord and Ash, 1979) for teeth 16, 14 and 37. Tooth 15 had grade 2 mobility. The bleeding on probing (BOP) percentage was 64% and the Plaque Control Record index was 61% (O’Leary et al, 1972).

Radiological Examination
The radiological examination showed that tooth 48 was impacted (Fig. 7). The endodontic treatments at teeth 16, 15, 12 and 15 were incomplete. There was a generalized horizontal bone loss and angular bony defects at teeth 14 (distally) and 23 (mesially).

Functional Analysis
The screening test for functional disturbances (Shore, 1959; Jenni, 1988) revealed that the patient had no pain or discomfort in the temporomandibular joints or related structures. The maximal opening of the mouth was 55 mm. The overbite and the overjet were within normal range. The patient had a neutral class I on both sides. There were no prematurities in centric relation and consequently no ‘slide in centric’. The working side yielded a group function on both sides. The patient admitted to chewing his pencils while working. The occlusal surfaces of the teeth showed marked abrasions because of the bruxism and loss of posterior support.

Diagnosis
Due to the findings of the examination the patient was classified to have ‘generalized chronic periodontitis with furcation involvement’ (Armitage et al, 1999). Other diagnoses included caries at...
teeth 23, 37, 38, incomplete endodontic treatments at teeth 16, 15, 12, 25, and parafunction and loss of posterior support.

Etiology

Obviously, the primary etiological factors consisted of supra- and subgingival plaque and calculus. The patient's smoking habit was considered as a modifying factor. Caries and defective fillings were contributing as secondary etiological factors.

Prognosis

A pre-therapeutic single-tooth prognosis (Table 3) was established. Based on the periodontal, endodontic and functional status every tooth was evaluated and attributed to one of the following categories: teeth with secure prognosis, doubtful prognosis, and teeth irrational to treat. Teeth that could be maintained without major therapeutic efforts were considered in the first category. Teeth that required major therapeutic efforts were included in the second category. The final category included teeth considered to be irrational to treat and where extraction was the only logical treatment option.

Pre-therapeutic Prognosis for Single Teeth

Tooth 48 was classified as being 'irrational to treat'. Teeth 16, 15, 14, 22, 23, 25, 47, 37 and 38 were given a doubtful prognosis because of furcation involvements, angular bony defects and/or incomplete root canal fillings. The remaining teeth were considered to have a secure prognosis (Table 4).

Treatment Prognosis

The patient was interested in having periodontal treatment and appeared to be very motivated. Unfortunately, despite prompting, he did not even appear to want to consider a reduction in his smoking habits. The periodontal situation of teeth 16 and 37 and their response to therapy was, therefore, crucial from a prosthetic point of view. Because of his heavy smoking habit the use of dental implants appeared risky. Assuming good compliance and collaboration, the prognosis for the remainder of the dentition appeared good.

Treatment Planning

The treatment plan consisted of four phases:

1. Systemic phase
2. Hygiene phase
3. Corrective phase
   3.1. Surgical interventions
   3.2. Reconstructive interventions

In the systemic phase, there was no need for further examinations of the patient's medical condition. Smoking counseling had been planned. The patient was also to be informed about the effects of his smoking on the treatment outcome and the risks in case of implant placement A testing of the IL-1 gene complex polymorphism status was considered.
in case of implant therapy (Feloutzis et al, 2003). The plan for the hygiene phase consisted of motivation, instruction in the Bass technique and of the use of interdental brushes. Debridement of all teeth under local anesthesia (scaling and root planing) was to be performed in a systematic way. Provisional fillings were planned for teeth 37 and 38. The loss of periodontal support was compatible with the age of the patient, the oral hygiene and his smoking history. Hence, no microbial testing was planned before or after the hygiene phase and no use of antibiotics was considered. The re-evaluation was planned to take place 8 weeks after the completion of the hygiene phase.

In the corrective phase additional therapy was anticipated. Two main treatment options were considered, namely: tooth-supported or implant-supported reconstructions (especially in the second and in the fourth quadrants). Because of his smoking status the treatment plan was performed with the focus on the maintenance of the strategic teeth 16 and 37.

For the surgical aspect, an access flap (modified Widman flap) was planned from tooth 14 to tooth 16 with an amputation of the distobuccal root of tooth 16. The extraction of tooth 16 and the placement of an implant following elevation of the sinus floor were not considered as an option because of the smoking issue. In the third quadrant, there were two possibilities: to maintain a premolar occlusion (extraction of 37 and 38), or to perform a hemisection on tooth 37 in order to use the mesial root as an abutment for a fixed partial denture 35 x 37, combined with the extraction of tooth 38. In the fourth quadrant, tooth 48 was planned to be extracted during access surgery at tooth 47. No implant placement was considered in the third quadrant. In the second and fourth quadrants, implant placement would have been an alternative to the closure of the gaps.

For the reconstruction of the dentition a single crown on tooth 15 and splinted crowns on the palatal and the mesiobuccal roots of tooth 16 (following endodontic re-treatment of tooth 16) were planned. In the second quadrant, a fixed partial denture from tooth 23 to 25 or a single implant (24) was considered. Due to the additional financial cost and the risks involved, the nature of the re-

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construction was still to be decided in the third quadrant. In the fourth quadrant, a fix partial denture from tooth 47 to 45 or a single implant (46) was planned. Because of the bruxism the patient was to be provided with a Michigan splint for the upper jaw to be used at night. The maintenance visits were initially scheduled every 3 months.

Treatment Sequence

As indicated in the treatment plan the treatment could be scheduled as planned and hence, the first two therapeutic phases followed a sequence identical to that of the treatment plan.

Systemic Phase

No further medical examinations were performed. The patient was informed about the effects of smoking on the periodontal treatment outcomes. The specific risks of an implant placement and the influence of smoking and of the IL-1 status on the long-term prognosis of an implant-supported reconstruction were also addressed. The patient found it impossible to attend a smoking cessation program.

However, the patient was willing to reduce his tobacco consumption, but with no guarantees of success. A testing of the IL-1 gene complex polymorphism was postponed until after the completion of the hygiene phase.

Hygiene Phase

At the beginning of the treatment the patient was informed about the etiology of periodontitis and caries. The periodontal and reconstructive problems were addressed with special focus on the smoking issue and on the maintenance of the strategically important teeth 16 and 37. The different treatment options and the financial aspects were also discussed. The importance of maintaining good oral hygiene, and complying with the recommendations made, was stressed for achieving optimal treatment outcomes.

The treatment sequence in the hygiene phase also followed the treatment plan. Motivation of the patient and instructions in the Bass technique and the use of interdental brushes were performed. The debridement of all teeth took place during 3 appointments under local anesthesia. Provisional fillings were placed on teeth 37 and 38. The patient was very motivated and improved his oral hygiene.
Fig. 10 Periochart after the hygiene phase. There are still pockets of 5 mm in the first and third quadrants. In the lower front, a great reduction of probing depths has been achieved.

successively. As a result, the Plaque Control Record (O’Leary et al, 1972) dropped to 10% from an initial 61%. During the hygiene phase the patient rinsed twice a day with a 0.1% Chlorhexidine solution (Hibitane®). The re-evaluation took place 8 weeks after completion of the hygiene phase (Fig. 8 and Figs. 9a, b). A great reduction in probing pocket depths took place following the instrumentation (Fig. 10). There were, however, still some residual pockets of 5 mm in the upper and lower molar regions. In the lower front region, from tooth 45 to tooth 35, no probing pocket depths greater than 4 mm were present. BOP was 29% (Lang et al, 1986) and the Plaque Control Record amounted to 13%. The goals of the hygiene phase to reduce pockets and inflammation had been reached. According to the quality assessment of the Swiss Society of Odontology (SSO 2000) (Table 5) a standard of A was reached because of the 5 residual pockets of 5 mm and a standard of B for the percentage of Bleeding on Probing (BO P) (Table 6).

Table 5 Quality assessment. Description of the tissues, patient compliance.

<table>
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<th>Quality assessment</th>
<th>Description of the tissues</th>
<th>Patient compliance</th>
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<tr>
<td>A +</td>
<td>No probing depths &gt; 4 mm</td>
<td>Very good plaque control</td>
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<td></td>
<td>Minimal bleeding on probing (&lt;10%)</td>
<td>Optimal collaboration</td>
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<td></td>
<td>No visible plaque/calculus</td>
<td>Very motivated patient</td>
</tr>
<tr>
<td>A</td>
<td>Moderate bleeding on probing (&lt;= 25%)</td>
<td>Good plaque control</td>
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<tr>
<td></td>
<td>Plaque Index &lt;= 30%</td>
<td>The recall is almost always followed</td>
</tr>
<tr>
<td>B</td>
<td>Residual probing depths &gt; 5 mm</td>
<td>Absence of motivation</td>
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<tr>
<td></td>
<td>Bleeding on probing &gt; 25 %</td>
<td>Low level of collaboration</td>
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<td></td>
<td>Plaque Index &gt; 30%</td>
<td></td>
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<tr>
<td>C</td>
<td>Abscesses, pus secretion</td>
<td>No interest in the treatment</td>
</tr>
<tr>
<td></td>
<td>Generalized bleeding on probing</td>
<td>Noncompliant patient</td>
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<td></td>
<td>Massive plaque accumulation</td>
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</table>
Corrective Phase

Surgical Interventions

Further therapy was indicated after successful completion of the hygiene phase. The patient was still a heavy smoker and had no intention of quitting. The different treatment options and risks involved with implant therapy and the extensive reconstructions were discussed. The patient preferred tooth-supported reconstructions. Because of the decision of not installing dental implants no testing for the IL-1 genotype was relevant. The patient clearly expressed his wish to receive more teeth in the third quadrant than a premolar occlusion could offer him. In order to use teeth 16 and 37 as abutments for the fixed partial dentures in the first and third quadrants, additional therapy was needed.

The final plan for the prosthetic reconstruction was as follows:

- In the first quadrant: a single crown on tooth 15, splinted crowns on the palatal and mesiobuccal roots of tooth 16
- In the second quadrant: a fixed partial denture from 23 x 25 with a distal extension
- In the third quadrant: a fixed partial denture from 35 x 37 to a hemisected tooth 37
- In the fourth quadrant: a fixed partial denture from 45 x 47.

In the first quadrant, modified Widman flap surgery was performed from tooth 14 to tooth 16 concomitantly with the amputation of the distobuccal root of 16 and the separation of the other 2 roots of 16. In the third quadrant, tooth 37 was hemisected during access flap surgery. The distal roots of teeth 37 and 38 were subsequently extracted. The mesial root yielded more remaining dentin and an angulation of the coronal part in parallel with tooth 35. A pulpal extirpation was performed on the mesial root of 37. The impacted tooth 48 was surgically extracted and the distal aspect of tooth 47 was re-instrumented. During the surgical healing periods the patient was rinsing with a 0.1% Chlorhexidine solution (Hibitane®).

Reconstructive Interventions

An endodontic re-treatment was performed for the palatal and the mesiobuccal roots of tooth 16. Also, the mesial root of tooth 37 was endodontically treated. Composite build-ups (Tetric®, Vivadent, Schaan/ Liechtenstein) were performed without the use of any posts on the mesiobuccal root of tooth 16 and on the mesial root of tooth 37. The amalgam filling on tooth 35 was replaced by a composite filling. A post (CM Dental, Cendres & Metaux SA) and core build-up (Tetric®, Vivadent, Schaan/ Liechtenstein) was performed on the palatal root of tooth 16 (Figs. 11a–f). No endodontic re-treatment was performed on teeth 15 and 25, since these teeth were asymptomatic and no periapical lesions were present. The existing posts were maintained and the cores were rebuilt with composites. The abutment teeth were prepared (bevel preparation) and provisional crowns and bridges inserted (Fig. 12). The inter-maxillary relationship was registered (Figs. 14a, b) after the final preparations (Figs. 13a–e) and impression-taking (Impregum® Espe, Seefeld, Austria). At the subsequent appointments the fit and retention of the framework was checked. The 2 roots of tooth 16 were splinted with the framework in a manner facilitating easy cleansing (Figs. 15a–d). The color of the prosthetic reconstruction was adjusted to fit the remaining teeth, also in the occlusal part of the fixed partial dentures. The distal cantilever of tooth 25 had only a centric stop with tooth 37 and no contacts in the lateral movements. After checking the occlusion, articulation and the aesthetic aspects, the fixed partial dentures were cemented with Ketak-Cem® (Espe, Seefeld, Austria) (Figs. 16 a, b). A new composite filling was placed on tooth 13. A splint made of heat cured acrylic and with a flat occlusal surface with canine guidance (Michigan splint) was given to the patient for use at night.

Six months after surgery and three weeks after the final insertion of the fixed partial dentures, a re-evaluation of the periodontal status was undertak-
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Figs. 11a-c  First quadrant.
Fig. 11a  Palatal view of teeth 15 and 16 before treatment

Fig. 11c  Palatal view after the root amputation and the extraction of the distobuccal root of 16.

Figs. 11d-f  Third quadrant.
Fig. 11d  Lingual view of teeth 37 and 38 before treatment

Fig. 11e  Lingual view of teeth 37 and 38 after hygiene phase.

Fig. 11f  Lingual view after the hemisection of tooth 37 and the extraction of the distal root of 37 and of tooth 38.

Fig. 12  Provisional crowns and fixed partial dentures were inserted in all four quadrants.
A beveled preparation was performed.

The preparation distally on the root 37 was slightly subgingival.

Lateral views. The mesial root of tooth 37 was parallel to tooth 35.
Three residual pockets of 5 mm were still present at teeth 14, 15, and 47. BOP was 17% and the Plaque Control Record was 20%. According to the quality assessment of the Swiss Society of Odontology (SSO 2000) (Table 5) the quality standard corresponded to an A. The patient compliance corresponded to a standard of B owing to the increased plaque scores (Table 7).

Figs. 15a–d  A single crown on tooth 15 and splinted crowns on the mesiobuccal and palatal roots of tooth 16 were cemented. The patient was able to clean between the crowns with interdental brushes.

Figs. 16a, b  Lateral views of the final restorations.

Table 7  Quality Assessment after surgical phase

Quality assessment 6 months after surgery
Description of the tissues: A
- 3 residual pockets of 5 mm
- Bleeding on probing 17% (< 25%)
- Plaque Control Record 20% (< = 30%)

Patient compliance: B
Maintenance Phase and Periodontal Risk Assessment (PRA)

Based on a Periodontal Risk Assessment (PRA) model (Lang and Tonetti, 2003) (Table 8), the patient was placed into a maintenance care program with a recall frequency every 4 months after the completion of the surgical phase. BOP was assessed and the probing pocket depths were measured at every recall visit. Supragingival deposits were removed, all bleeding sites were re-instrumented and fluorides applied to the tooth surfaces. The Plaque Control Record of the patient varied from time to time and often scores of 30% to 40% were observed. The patient was periodically re-instructed and re-motivated. The night splint was periodically checked. The PRA after both the hygiene and surgical phases is presented in Figs. 18a, b.

Table 8  Periodontal risk assessment (PRA) for patients in supportive periodontal therapy

<table>
<thead>
<tr>
<th>The PRA is a functional diagram based on the evaluation of 6 parameters:</th>
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<tr>
<td>1. Percentage of bleeding on probing</td>
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<td>2. Prevalence of residual pockets greater than 4 mm (≥5 mm)</td>
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<td>3. Loss of teeth from a total of 28 teeth</td>
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<td>4. Radiographic alveolar bone loss in relation to patient’s age</td>
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<td>5. Systemic (e.g. diabetes) and genetic conditions, if tested or known</td>
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<td>6. Environmental factors, such as cigarette smoking.</td>
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The area of the diagram represents the subject risk for progression of periodontal disease and is used to assess the frequency of the recall interval (see Lang and Tonetti, 2003).
Evaluation 2 years after the Final Reconstruction

Two years after the last examination, a new periodontal chart and a full radiographic examination was carried out (Figs. 19a–c). At the 2 year re-evaluation a thorough standard of oral hygiene was re-established (plaque scores of 11%) even though the patient had cleaned less well at the last recall visits (plaque scores of 30% to 35%). BOP was 20%. There was, however, a slight worsening of the periodontal situation in localized areas (Fig. 20a). Probing pocket depths of 5 mm and 6 mm were scored between teeth 15 and 14, and at the furcation area of 14. Probing pocket depths of 5 mm were also present at teeth 16 (distal root), 47, 43, 32 and 37. Nonetheless, the radiographs (Fig. 20b) revealed stable periodontal conditions around almost all teeth. The lamina dura of the alveolar bone was clearly recognizable with the exception of the interdental spaces between the teeth 15 and 16, 32 and 33. All non-endodontically treated teeth were vital and no caries was detected. All the fixed partial dentures were functional, and the patient was satisfied. The patient still smoked heavily (1 to 2 packs a day). The Michigan splint was worn almost every night. Two years after therapy, because of the presence of 10 sites with probing depths of more than 4 mm and because of the compliance of the patient, the quality standard corresponded to a B standard (Table 9, see next page).
Fig. 18a  Periodontal risk assessment (PRA) after hygiene phase
After hygiene phase, BOP was 29%, there were 5 residual pockets of 5mm or more, 6 teeth had been lost, the radiographic bone loss score was 0.77 (40% bone loss/ age 52 years = 0.77), systemically healthy patient and the patient was a heavy smoker. The recall interval was set at 3 months. (IL-1 polymorphism was not tested)

Fig. 18b  Periodontal risk assessment (PRA) after surgical phase
BOP was 17%, there were 3 residual pockets of 5mm or more, 7 teeth had been lost, the radiographic bone loss score was 0.75 (40% bone loss/ age 53 years = 0.75), systemically healthy patient and the patient was still a heavy smoker.
The area of the diagram decreased as a result of the additional therapy. The recall interval was set at 4 months.

Fig. 19a-c  Two years after completion of treatment, all the reconstructions were functioning.

Table 9  Quality Assessment 2 years after the final reconstruction

Quality assessment after 2 years
Description of the tissues: B

- 10 residual pockets of ≥ 5 mm
- Bleeding on probing 20% (< 25%)
- Plaque Control Record 11% (< = 30%)

Patient compliance: B
Fig. 20a The perio chart at the 2 year re-evaluation documents an increase in localized areas with probing depths $\geq 5$ mm.

Fig. 20b Radiographic examination 2 years after final reconstruction. No technical or biological complications were observed at the 2 year re-examination.
Based on the most recent examinations it was decided to monitor the oral hygiene condition of the patient to assure low plaque scores. At the following recall appointment the Plaque Control Record was 8% and BOP was 7% (Fig. 21). There were localized sites which exhibited BOP and probing pocket depths ≥ 5 mm. Therefore, after reinstrumentation, a decision was taken to retreat these localized areas with a sustained-release biodegradable Doxycyclin polymer AtridoxTM® (Heico Dent).

Recall Prognosis
Based on the previous PRA (Fig. 22), the patient was recalled every 3 months. A good prognosis for the entire dentition could now be attributed to the patient.

DISCUSSION

Three years after the start of the treatment, the patient's periodontal and functional situations had improved markedly (Figs. 23a, b). The patient's compliance during the treatment was good. Even though there had been periods with less adequate plaque control, the patient could return to an appropriate oral hygiene level after re-motivation and re-instruction. The patient was still a heavy smoker (1 to 2 packs/day). Even though the adverse effects of smoking on the outcome of scaling and root planing (Preber et al, 1986 a, b; Kaldahl et al, 1996) and flap surgery (Preber et al, 1990; Kaldahl et al, 1996) are well known, the patient responded well to the treatment. At the initial examination, BOP was 64% and the Plaque Control Record was 61%. These values dropped to 29% and 13%, respectively after the hygiene phase and to 17% and 20%, respectively after the surgical phase. After completion of active therapy, the patient was placed on a 3 to 4 month recall. During supportive periodontal therapy the BOP dropped further to 7% and the plaque scores to 8%. The localized sites which showed deepening of probing pocket depth and BOP at the 2 year re-evaluation were treated with a sustained-release biodegradable polymer AtridoxTM® (Heico Dent). Several
studies have shown an increase in probing depth reduction and clinical attachment gain after application of doxycycline-sustained devices in combination with debridement (Wennström et al, 2001) or alone (Garrett et al, 1999, 2000) in the treatment of chronic periodontitis. Also, in terms of probing pocket depth reduction and clinical attachment gain, current smokers seem to respond as favorably as former smokers or non-smokers to the application of controlled-release doxycycline alone (Ryder et al, 1999).

Because the patient was a heavy smoker, reconstruction of the occlusion without the use of oral implants was preferred for the rehabilitation. Many authors report high early-implant and post-loading failures in smokers as compared to non-smokers (Bain et al, 1993; De Bruyn et al, 1994; Wallace et al, 2000). A test to identify the IL-1 gene complex polymorphisms of the patient was not performed, since the patient decided to have a tooth-supported reconstruction. A positive outcome of the test in heavy cigarette smokers has been associated with an increased risk for peri-implant bone loss following prosthetic reconstruction in spite of supportive periodontal care being rendered (Feloutzis et al, 2002). Smokers appear to exhibit higher peri-implant probing depth, bleeding indices (Haas et al, 1996) and bone loss irrespective of the IL-1 genotype (Lindquist et al, 1997; Haas et al, 1996).

Moreover, in patients with a past history of periodontitis, the long-term implant prognosis appeared lower and the incidence of peri-implantitis higher than for patients without a history of periodontitis (Karoussis et al, 2003). Because of the patient's desire for a fixed prostodontic reconstruction teeth 16 and 37, which initially had a doubtful prognosis, became strategically important. An extraction of tooth 16 would have resulted in extensive bone loss, and an implant placement in this area would have most probably required an elevation of the maxillary sinus floor. In a heavy smoker, however, such procedures and subsequent implant therapy would have been risky. Several studies reported high failures rates for implants placed into grafted maxillary sinuses in smokers (Geurs et al, 2001; Kann et al, 1999). Because teeth 16 and 37 had Grade 3 furcation involvement (per Hamp et al, 1975 Classification), additional treatment in terms of endodontic treatments/revisions, and periodontal surgical procedures was necessary to use these teeth as abutments for fixed bridgework.

Several studies reported survival rates of 89% or higher after root resective therapy (Klavan et al, 1975; Carnevale et al, 1998, 1991; Hamp et al, 1975; Bergenholz et al, 1972; Erpenstein et al, 1983; Svärdström et al, 2000). In their study of patients on supportive periodontal therapy, Carnevale et al (1998) found that the survival rate of root-resected teeth after 10 years was 93%. The resected roots (234 roots out of 175 furcation-involved teeth) were used as: terminal abutments for fixed bridge reconstruction (60%); intermediate abutments (24%); and also abutments for single crown restorations (16%). During 10 years of maintenance, the recurrence of periodontitis leading to extractions was only 2%. The prosthetic survival rate at 10 years was 97%.

The rationale for extractions was most likely endodontic in nature; or caries and root fractures may also have contributed. Periodontal disease re-
currence, however, seemed to be the least common reason for extraction (Carnevale et al, 1998; Erpenstein et al, 1991; Erpenstein et al, 1983; Bühler et al, 1988). The failure rates reported vary from 0% after 5 years (Hamp et al, 1975) to 38% after 10 years (Langer et al, 1981). The palatal and the mesiobuccal roots of tooth 16 were maintained in the present patient after separation of all roots (Grade 3 furcation involvement). These roots had a greater amount of supporting bone than the mesiobuccal root. Furthermore, they were not mobile after the separation, had a favorable position in the dental arch, and had good periapical conditions. The endodontic re-treatment was performed without difficulty. For the restoration, composites for the mesiobuccal root and post and composites for the palatal root were performed. The two roots were splinted with the framework to improve stability and to allow proper cleansing. In the lower arch, the mesial root of tooth 37 was maintained. The residual dentinal core permitted the build-up with composites only. At the 2 year examination, the single crowns and the fixed partial denture in the third quadrant did not disclose any problems.

Even though an increased risk of complications for fixed partial dentures with extensions has been reported (Randow et al, 1986 a, b; Landolt et al, 1988), a fixed partial denture was placed in the second quadrant to avoid implant installation. An increased risk of root fractures (35%) has also been reported (Landolt et al, 1988) for extension bridges when compared to conventional reconstructions. However, Lindquist et al (1998) reported no difference in the survival rate (65%) of fixed partial dentures with or without extensions after 20 years. A heat cured acrylic Michigan night splint (Ash et al, 1994; Geering et al, 1978) was fabricated to reduce the risks of technical failures due to nocturnal bruxism.

Two years after completion of treatment the periodontal situation of this heavy smoking patient was under control, and no technical complications occurred. Extensive surgical and prosthetic fixed bridgework interventions were performed to satisfy the patient's wish for a fixed reconstruction without the installation of oral implants. The patient continues to attend a three to four-month recall to further monitor and maintain the treatment results through supportive periodontal care.

REFERENCES


Reprint requests:
Prof. Dr. Dr. h.c. Niklaus P. Lang, M.S.
Department of Periodontology and Fixed Prosthodontics
School of Dental Medicine
University of Berne
Freiburgstrasse 7
CH-3010 Bern, Switzerland
Fax: +41 31 632 4915
E-mail: perio@zmk.unibe.ch

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Institut für Angewandte Immunologie IAI
Eschenweg 6, CH-4528 Zuchwil, Switzerland
Phone +41 32 685 54 62
Fax +41 32 685 54 92
e-mail: IAI@swissonline.ch